DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to the multilayered information medium which carries out the two-layer owner of the information holding layers, such as a recording layer, at least, and the method of manufacturing this medium.

[0002]

[Description of the Prior Art]In recent years, the demand of densification and large-scale-izing to an optical disc is remarkable. Although DVD (Digital Versatile Disk) with the storage capacity of about 4.7 GB of one side corresponding by about 7 times the compact disk is released now, development of the art which can record more information is performed briskly.

[0003]As art which raises the storage capacity of an optical disc, the short wavelength formation of record reproduction light, a raise in NA (numerical aperture) of the object lens in a record reproduction Mitsuteru light reflection study system, multilayering of a recording layer, multiple-value record, etc. are mentioned. Compared with short wavelength formation or a raise in NA, fast high-capacity-izing is [among these] possible for the three-dimensional record by multilayering of a recording layer at low cost. The three-dimensional-record medium is indicated, for example to JP,9-198709,A. To JP,8-255374,A, the medium which laminated the rewritable information storage layer and the information storage layer only for reproduction is indicated.

[0004]

[Problem(s) to be Solved by the Invention]In a multilayer recording medium, the high transparent resin layer of transparency is usually provided to record and regenerated light between adjacent recording layers, a transparent resin layer is penetrated, a recording layer is reached, it reflects on the recording layer surface, and record and regenerated light return to an optical pickup. Therefore, thickness, ****, and homogeneity severe about an optical property

are required of a transparent resin layer. As for a transparent resin layer, when a medium is a disk-like, forming with a spin coat method is common. A comparatively homogeneous transparent resin layer can be formed in a spin coat method. However, the transparent resin layer formed with the spin coat method will become thick by a disk peripheral part compared with a disk inner periphery. That is, a thickness distribution will arise in the disk diameter direction. In order for the number of transparent resin layers to also increase as the number of laminations of a recording layer increases, the thickness distribution of a transparent resin layer will be accumulated. As a result, even if record and regenerated light entered at right angles to a medium surface in the disk peripheral part, the record and regenerated light reflected on the recording layer surface will not become vertical to a medium surface, but, as a result, its amount of returned light to an optical pickup will decrease. Therefore, a reproducing output will be changed by the inner periphery and a peripheral part.

[0005]If the peripheral part of the transparent resin layer inserted among both bases becomes thick when considering it as the bonding type optical disc which sandwiched the recording layer between two bases, it will be easy to produce curvature and distortion in an optical disc, and it will become difficult to make machine accuracy high.

[0006]By the way, when reproducing the multilayer recording medium which multilayered the recording layer, the catoptric light from recording layers other than a reproduction object, i.e., recording layers other than the recording layer in which regenerated light is focusing, will also return to the optical pickup which irradiates with regenerated light. Therefore, signal interference arises among two or more recording layers, and this serves as a cross talk. As a result, a noise will mix in a regenerative signal. The influence of the catoptric light which returns from recording layers other than a reproduction object becomes small in inverse proportion to the square of the distance between recording layers. Therefore, it is so desirable that the distance between recording layers is large in order to suppress mixing of a noise. For example, when using the optical pickup of the usual structure where it is used for playback of the conventional optical discs, such as DVD, in order to acquire a practical signal quality, it is desirable for at least 30 micrometers of distance between recording layers to be not less than 70 micrometers preferably. In the example of above-mentioned JP,9-198709,A, the 100-micrometer-thick transparent resin layer is actually provided between recording layers. In above-mentioned JP,8-255374,A, the distance between adjacent two-layer information storage layers is set as not less than 30 micrometers.

[0007]However, when distance between recording layers is enlarged with not less than 30 micrometers, in order to prevent a disk becoming thick too much, the number of laminations of a recording layer will be restricted, therefore the storage capacity of an entire disk will also be restricted. It is difficult to form a not less than 30-micrometer thick transparent resin layer in uniform thickness. Since internal stress becomes large, a thick resin layer tends to produce

curvature to a medium. Therefore, there is a problem that machine accuracy reservation of an optical disc is difficult.

[0008]On the other hand, in order to make small the cross talk in the recording layer in a multilayer recording medium, For example, using JP,10-222856,A and the optical pickup provided with the confocal detecting optical system which applied the principle of the confocal microscope to reproduction of each recording layer as indicated to SOM'94 technicaldigest (1994)19 is proposed. In an optical pickup provided with a confocal detecting optical system, a pinhole is arranged in an optical system and it reproduces by the light passing through this pinhole. Therefore, since the flattery range of a focus servo becomes narrow when using an optical pickup provided with a confocal detecting optical system, it is required that the homogeneity of the thickness of a transparent resin layer should be higher.

[0009]In addition, there are also the following problems in a multilayer recording medium. In the medium which has a recording layer of a monolayer, a groove is transferred by the recording layer by forming the groove (guide rail) in the resin matrix in which a recording layer is formed. However, when laminating the recording layer more than two-layer via a comparatively thick transparent resin layer, it is difficult to transfer the groove provided in the base to all the recording layers. That is, groove depth is at most about 100 nm from an optical demand, and, on the other hand, it is because interlaminar distance is remarkably thick compared with this. therefore, it is indicated, for example to said JP,9-198709,A -- as -- a photopolymer (2P) -- a groove must be formed in a transparent resin layer using law etc. Therefore, a manufacturing cost will rise remarkably.

[0010]In the multilayered information medium which has two or more information holding layers, an object of this invention is to provide such a multilayered information medium by low cost for the purpose of acquiring good machine accuracy in a multilayered information medium for the purpose of realizing good reproducing characteristics by all the information holding layers.

[0011]

[Means for Solving the Problem]Such a purpose is attained by this invention of following the (1) - (5).

(1) Between disk-like bases of a couple on a disk-like base which has a feed hole, The two-layer owner of the circular information holding layer holding recorded information and/or servo data is carried out at least, An information holding layer to whom record or reproduction is given by recording light or regenerated light which penetrated other information holding layers exists, An optical information medium laminated stair-like so that it may have at least a two-layer resin layer which is circular and has annular heights in an internal circumference edge and these each resin layer may not cover said annular heights of other resin layers.

(2) An optical information medium of the above (1) whose thickness of a resin layer which

exists between information storage layers holding recorded information is not less than 5 micrometers less than 30 micrometers.
(3) The above (1) or (2) optical information media with which a confocal detecting optical system is used for an information holding layer's rebirth.
(4) One optical information medium of above-mentioned (1) - (3) divided into a data layer in which an information holding layer holds recorded information, and a servo layer holding servo data.
(5) The above (1) Are the method of manufacturing one optical information medium of - (4), and said base is laid on a rotating table, By changing into the state where a blocking means which has a disk part closed said feed hole, and rotating said base with said blocking means, after supplying coating liquid containing resin on said disk part, A manufacturing method of an optical information medium which has a process of spreading said coating liquid on said base, and forming a resin layer, a process of making said resin layer annular by estranging said disk part from said base, and forming annular heights in that internal circumference edge, and the process of hardening said resin layer, in this order.
[0012]
[Embodiment of the Invention]The optical information medium with which this invention is applied has the structure where two-layer lamination of the information holding layer was carried out at least. A data layer and a servo layer are included by the information holding layer in this specification. A data layer is a layer in which the recording mark holding recorded information, a pit, etc. exist, and a servo layer is a layer in which the tracking servo pattern which consists of unevenness of a groove, a pit, etc. exists. However, when not providing a servo layer independently to a data layer, a tracking servo pattern is formed in a data layer.
[0013]In this specification, the light for recording on the light and the data layer for reading a data layer is called data light, and the light for reading a servo layer is called servo light. In this specification, record and regenerated light are concepts which include data light and servo light.
[0014]The multilayered information medium in this specification is a medium by which the information holding layer to whom record or reproduction is given by the record and regenerated light which has two or more information holding layers, and penetrated other information holding layers exists.
[0015]An optical recording medium and an only for [reproduction] type medium are included by the optical information medium of this invention. A recording layer is contained in a data layer in an optical recording medium. In the only for [reproduction] type medium, the pit or recording mark holding data is beforehand formed in the data layer.
[0016]The example of composition of the multilayer medium of this invention is shown in drawing 1 as a sectional view. As for the medium shown in drawing 1, on the base 2 in which

the groove for tracking was provided, two-layer data layer DL-1 and DL-2 are laminated, filter layer floor line exists among both data layers, and hyaline layer tangent line exists on data layer DL-2. Hyaline layer tangent line functions as a protective layer. In this medium, reproduction of data layer DL-1 and DL-2 enters two sorts of regenerated light in which wavelength is different from the figure Nakashita side, and is performed by detecting that catoptric light by an optical pickup. When this medium is an optical recording medium, it usually glares from an optical pickup with same recording light and regenerated light, and let recording light and regenerated light be identical wavelengths.

[0017]Filter layer floor line in the medium of this invention shown in drawing 1 has a rate of the data absorption of light higher than the rate of the data absorption of light for reading upper data layer DL-2 for reading lower data layer DL-1. Therefore, when reading data layer DL-1, as a result of the intensity of the regenerated light which reaches data layer DL-2 becoming low, the influence of the catoptric light from data layer DL-2 can be suppressed. On the other hand, since there is little data absorption of light by filter layer floor line when reproducing data layer DL-2, trouble is not produced in reproduction. Therefore, even if it makes small distance between data layer DL-1 and data layer DL-2, there are few cross talks produced between data layers. On the other hand, if a hyaline layer is not made thick enough when the high hyaline layer of transparency is changed to filter layer floor line and provided to record and regenerated light, When reading by making data layer DL-1 by the side of figure Nakashita focus, an optical pickup also gathers the catoptric light from upper data layer DL-2, and this serves as a reproduction noise.

[0018]Since the influence of a cross talk will become small if storage density is low although influenced by the catoptric light from lower data layer DL-1 when reproducing upper data layer DL-2, it is preferred to set up the storage density of DL-2 in the composition shown in drawing 1 lower than DL-1. In that case, the data light wavelength used for record and reproduction of DL-2 is usually made longer than the data light wavelength used for record and reproduction of DL-1.

[0019]Other examples of composition of the medium of this invention are shown in drawing 2. The medium shown in drawing 2 provides data layer DL of one layer on the base 2, and laminates the servo base 20 via filter layer floor line on this data layer DL. The tracking servo pattern which consists of a groove and/or a pit is provided in the servo base 20. The reflecting layer is formed in record and the regenerated light incidence side surface of this servo base 20, and this functions as servo layer SL.

[0020]When reproducing the medium shown in drawing 2, the data light which reads data layer DL is the servo light of different wavelength, and servo layer SL is read. The above-mentioned rate of the data absorption of light of filter layer floor line in this medium is higher than the above-mentioned rate of the servo absorption of light. Therefore, on the occasion of read-out

of data layer DL, it is hard to mix the reproduction noise resulting from reflection of the data light from servo layer SL.

[0021]Since read-out of servo data, such as tracking servo information, cannot be easily influenced by a noise compared with read-out of a data layer, it can read the data layer of high recording density by a low noise in the composition shown in drawing 2, and a highly precise servo is possible for it. In drawing 2, since servo layer SL is formed independently, data layer DL can be used as a smooth layer.Therefore, the reflectance of data layer DL becomes high. Interference by the level difference of a tracking servo pattern does not occur. The noise under the influence of meandering of irregular shape, for example, a groove, such as collapse of a tracking servo pattern, etc. does not occur. In the composition shown in drawing 2, wavelength of data light is usually made shorter than the wavelength of servo light.

[0022]Here, the example of composition of an optical pickup applicable to record and reproduction of the multilayered information medium of this invention is shown in drawing 4 with the medium of the structure shown in drawing 2.

[0023]In this optical pickup, data light is emitted from laser diode LD1. After data light's penetrating the lens L1, making it into a parallel beam and penetrating polarization beam splitter PBS1 further, dichroic mirror DCM which has permeability to 1/4 wavelength plate QWP1 and data light is penetrated, It enters into the object lens L4, and is condensed by data layer DL of a multilayered information medium. After the data light reflected by data layer DL follows a course contrary to the time of incidence to a medium, it reflects by polarization beam splitter PBS1, and is condensed by photodetector PD1 with the lens L5, and detection of the focus servo to data layer DL or this, and a regenerative signal is performed.

[0024]The data light which reflects by servo layer SL and returns to an optical pickup will go and come back to filter layer floor line, and in the medium shown in drawing 4, since filter layer floor line exists between data layer DL and servo layer SL, it will decrease it remarkably. Therefore, when reproducing data layer DL, noise generating resulting from the reflection from a servo layer can be controlled remarkably.

[0025]On the other hand, after being emitted from laser diode LD2, reflecting by polarization beam splitter PBS2 and servo light's penetrating lens L6, and 1/4 wavelength-plate QWP2, it is reflected by dichroic mirror DCM and it enters into the object lens L4. The servo light emitted from the object lens L4 is condensed by servo layer SL. After the servo light reflected by servo layer SL follows a course contrary to the time of incidence, polarization beam splitter PBS2 is penetrated, it is condensed by photodetector PD2, and a tracking servo and the focus servo to a servo layer are performed.

[0026]Using the optical pickup of such composition, i.e., an optical pickup provided with dichroic mirror DCM which has the spectral characteristic which reflects servo light and data light penetrates, It is advantageous when reproducing separating a data layer and a servo

layer and irradiating with data light and servo light simultaneously. That is, it can prevent being able to prevent the catoptric light of servo light entering into photodetector PD1 for data photodetection, and the catoptric light of data light entering into photodetector PD2 for servo photodetection.

[0027]However, dichroic mirror DCM will not be able to penetrate data light thoroughly, but will reflect a part. Therefore, if a hyaline layer exists instead of filter layer floor line to illustrate, a part of data light reflected by servo layer SL will reach photodetector PD2 for servos, and it will have an adverse effect on a tracking servo. When data luminous intensity is high especially, in irradiating with the data light for record, for example, the above-mentioned adverse effect becomes large. On the other hand, if filter layer floor line is provided between data layer DL and servo layer SL so that it may illustrate, since data light is remarkably decreased by going and coming back to filter layer floor line, it can inhibit remarkably the adverse effect which data light has on a tracking servo.

[0028]Other examples of composition of the multilayer medium of this invention are shown in drawing 3. Hyaline layer tangent line[of five layers]-1 - tangent line-5 exist on the base 2, and, as for the medium shown in drawing 3, data layer DL[of four layers]-1 - DL-4 exist between adjacent hyaline layers, respectively. On hyaline layer tangent line-5, filter layer floor line, servo layer SL, and the servo base 20 exist in this order. The tracking servo pattern which becomes the servo base 20 from a groove and/or a pit is provided, and this pattern is transferred by servo layer SL.

[0029]The medium shown in drawing 3 is the same composition as the medium which there are many data layers and also is shown in drawing 2. Since it is difficult for the number of data layers to form a tracking servo pattern in each of a data layer with high precision by low cost two or more as it is three especially or more, the structure of providing a data layer and a servo layer independently is effective.

[0030]In drawing 3, although filter layer floor line is provided between data layer DL-4 and servo layer SL, the filter layer is not provided between adjacent data layers. Therefore, a cross talk will become large if distance between data layers is shortened. In order to make a cross talk small in this composition, it is preferred to use an optical pickup provided with the confocal detecting optical system which applied the principle of the confocal microscope to reproduction of each data layer. Since an optical pickup provided with a confocal detecting optical system has the very high resolution of the thickness direction of a medium, the cross talk between data layers can be reduced remarkably. The confocal detecting optical system which can be used for reproduction of a multilayered information medium is indicated, for example to JP,10-222856,A and SOM'94 technicaldigest(1994)19.

[0031]The example of composition of the optical pickup which can be provided with a confocal detecting optical system, and can be applied to record and reproduction of a multilayered

information medium is shown in drawing 5 with a medium. The medium to illustrate is the structure where data layer DL-1, hyaline layer tangent line, data layer DL-2, filter layer floor line, servo layer SL, and the servo base 20 were laminated in this order on the base 2.

[0032]This optical pickup is the same composition as the optical pickup which the lens L2, pinhole plate PHP, and the lens L3 were incorporated in the optical path of data light between polarization beam splitter PBS1, and 1/4 wavelength-plate QWP1, and also is shown in drawing 4.

[0033]In this optical pickup, the data light which penetrated polarization beam splitter PBS1 is condensed with the lens L2. Pinhole plate PHP which has a pinhole is arranged in the condensing position, and after data light which escaped from this pinhole is made into a parallel beam with the lens L3, it is condensed by data layer DL-1 of the multilayered-information-medium bottom through the same course as the optical pickup shown in drawing 4. The data light reflected by data layer DL-1 follows a course contrary to the time of incidence to a medium. Data light penetrates data layer DL-1 of a reproduction object, and reaches data layer DL-2, and the catoptric light also returns to an optical pickup. However, since this data light serves as out of focus to data layer DL-2, the catoptric light from data layer DL-2 is not condensed by the pinhole position of pinhole plate PHP, but since it spreads, most will be intercepted by pinhole plate PHP in a pinhole position. Therefore, the cross talk between data layers can be controlled by using an optical pickup provided with a confocal detecting optical system.

[0034]Next, the composition of each part of the optical recording medium of this invention is explained in detail.

[0035]The filter layer shown in filter layer drawing 1 - drawing 3 is a high layer more relatively [one absorptivity of two sorts of record and regenerated light (two sorts of data lights or data light, and servo light)] than the absorptivity of another side. Specifically, the absorptivity of one record and regenerated light is not less than 90% more preferably not less than 80%. If this absorptivity is too low, the effect of this invention will become insufficient. On the other hand, the absorptivity of record and regenerated light of another side is 10% or less more preferably 20% or less. If this absorptivity is too high, a rebirth of the information holding layer by the record and regenerated light which enters through a filter layer will become difficult, and it will become difficult [record] in the case of a recording medium.

[0036]Especially the component of a filter layer has various coloring matter which is not limited, should just choose suitably the material in which the desired spectral extinction characteristic is shown, for example, consists of organic materials or an inorganic material, especially preferred organic coloring matter, and what contains resin in addition to coloring matter is still more preferred. As resin, what was hardened with activity energy lines, such as ultraviolet rays, is preferred. It is not coloring matter independent and formation of a filter layer becomes

easy by mixing resin. For example, if it irradiates with ultraviolet rays after carrying out the spin coat of the mixture of an ultraviolet curing setup-of-tooling product and coloring matter, it is possible to form a homogeneous and comparatively thick filter layer for a short time.

[0037]The coloring matter in particular used for a filter layer is not limited, but satisfies the spectral extinction characteristic required of a filter layer, and should just use [just] various organic coloring matter, such as a cyanine system, a phthalocyanine system, and azo. Denaturation for providing a substituent etc. in a side chain to coloring matter in consideration of compatibility with resin may be performed if needed. In order to make control of the spectral extinction characteristic easy, it is good also as a filter layer to laminate the pigment layer more than two-layer [in which the spectral extinction characteristic is different].

[0038]Although what is necessary is just to determine suitably according to the kind of resin so that coloring matter content in particular may not be limited but the spectral extinction characteristic demanded may be satisfied when a filter layer contains coloring matter and resin, it is usually preferred that it is one to 10 mass %. If there is too little coloring matter content, it will be necessary to thicken a filter layer and is not desirable. On the other hand, pot life will become short if there is too much coloring matter content.

[0039]When the wavelength for absorption is comparatively short, for example it makes a steep absorption feature profitably like in a wavelength band of 450 nm or less, a filter layer can also consist of ultraviolet-curing-type-resin layers which do not contain coloring matter. An ultraviolet-curing-type-resin layer is formed by carrying out ultraviolet curing of the coat of the constituent containing an ultraviolet curing setup-of-tooling product and a photopolymerization initiator. A photopolymerization initiator shows big absorption near the wavelength of the light used for hardening. And the absorption near [the] wavelength also with a big coat after hardening is shown. It does not decompose thoroughly in the case of hardening of a photopolymerization initiator, but this is considered because it remains after the part has remained thru/or denaturalized. Therefore, it can be used as a filter layer which shows big absorption selectively in a short wavelength region.

[0040]The photopolymerization initiator in particular used for a filter layer is not limited, but For example, benzoic ester. What is necessary is just to choose from the usual photopolymerization initiators, such as a benzophenone derivative, a benzoin derivative, a thioxan ton derivative, an acetophenone derivative, a propiophenone derivative, and benzyl, suitably according to the wavelength for absorption.

[0041]Although the thickness of a filter layer should just determine suitably that it will satisfy the spectral extinction characteristic demanded, in the filter layer which contains resin and uses coloring matter or a photopolymerization initiator as an absorbent material, it is preferred to set up within the limits of 1-30 micrometers. If a filter layer is too thin, it will become difficult to acquire sufficient absorption feature. On the other hand, since a medium will become thick if

a filter layer is too thick, the number of laminations of a data layer is restricted and it is not desirable.

[0042]When the wavelength for absorption is comparatively as short as 450 nm or less, the metal layer containing at least one sort of a metal (semimetal is included) element can also be used as a filter layer. That to which an absorptivity becomes high rapidly in a short wavelength region, for example like Au exists in metal. Therefore, what is necessary is just to choose the thickness of a metal kind and a filter layer so that sufficient absorptivity can be secured in the wavelength band for absorption and sufficient transmissivity can be secured in the wavelength band for a penetration. As metal preferably used for a filter layer, Au, Pt, Cu, etc. are mentioned, for example. In order to make control of the spectral extinction characteristic easy, it is good also as a filter layer to laminate two or more sorts of metal layers in which the spectral extinction characteristic is different.

[0043]Although the thickness of the metal layer used as a filter layer changes also with metal kinds to be used, it is 20-100 nm more preferably 10-200 nm. If a metal layer is too thin, sufficient absorptivity will not be acquired in the wavelength band for absorption, and if a metal layer is too thick, sufficient transmissivity will not be obtained in the wavelength band for a penetration.

[0044]In addition, an interference filter can also be used as a filter layer. What sandwiched the dielectric film as an interference filter between the dielectric multilayer and the two-layer metal thin film which consists of Ag etc. is mentioned.

[0045]In drawing 3, although between a data layer and servo layers has provided the filter layer only in one between adjacent information holding layers, it may be provided among other information holding layers if needed. That is, three or more sorts of lights which provide a filter layer two or more and from which wavelength differs as record or regenerated light may be used. For example, data layer DL-1, DL-2, and DL-3 are provided in this order from the light incidence side, Provide filter layer floor line-1 between DL-1 and DL-2, and provide filter layer floor line-2 between DL-2 and DL-3, respectively, and DL-1 on the wavelength of 400 nm. When reproducing DL-2 on the wavelength of 600 nm and reproducing DL-3 on the wavelength of 800 nm, respectively, filter layer floor line-1 has a high absorptivity near the wavelength of 400 nm, and its an absorptivity should be just low near the wavelength of 600 nm, and near the wavelength of 800 nm. On the other hand, although the absorptivity in particular in near the wavelength of 400 nm is not limited, filter layer floor line-2 has a high absorptivity near the wavelength of 600 nm, and its an absorptivity should be just low near the wavelength of 800 nm.

[0046]Namely, the record and regenerated light in which the number of filter layers is n, for example, and wavelength is different n+1 in the medium applied to the system to be used. Each filter layer has a relatively high absorptivity of the record and regenerated light used for

the filter layer by the nearest information holding layer at the light incidence side, and its absorptivity of the record and regenerated light used for the information holding layer who exists in the optical outgoing radiation side of the filter layer should be relatively low just. In this explanation, a high absorptivity is preferred, it is not less than 90% more preferably, and a low absorptivity is 10% or less more preferably 20% or less relatively not less than 80%.

[0047]When providing two or more filter layers, it is necessary to use an optical absorption material of the same kind for no filter layers. For example, it may use combining a metal layer, or an interference filter and a coloring matter content filter layer.

[0048]In drawing 3, the reflecting layer (servo layer SL) provided in the servo base 20 surface can also be used as a filter layer instead of providing a filter layer between a data layer and a servo layer. When applying this invention to an only for [reproduction] type medium, may form a pit in a hyaline layer or a filter layer, may form a translucent reflecting layer in that pit forming face by a sputtering technique etc., and may use this reflecting layer as a data layer, but. In this case, the reflecting layer constituted from metal, semimetal, etc. can be used also as a filter layer. Each filter layer which serves as an information holding layer in these cases has the relatively high reflectance of the record and regenerated light used for the filter layer, and its reflectance of the record and regenerated light used for the filter layer by the nearest information holding layer at the light incidence side should be relatively low just. When an information holding layer exists in the optical outgoing radiation side of the filter layer further, the transmissivity of the record and regenerated light used for those information holding layers should be relatively high just.

[0049]Although the concrete wavelength in particular of two or more record and each regenerated light in which wavelength is different is not limited, 50-700 nm of differences of the wavelength of each record and regenerated light are 100-400 nm more preferably. Since the steep spectral extinction characteristic is needed for a filter layer when this bandgap wavelength is too small, selection of a filter layer component becomes difficult. On the other hand, if this bandgap wavelength is too large, it will stop being able to make storage density as the whole medium high, and sufficient servo accuracy will no longer be obtained.

[0050]300-1000 nm of wavelength bands where two or more record and regenerated light exist are 400-800 nm more preferably. The semiconductor laser which oscillates the laser beam of wavelength shorter than this is difficult to receive, and on the other hand, if the laser beam of long wave length is used, high-density record and the reproduction of information by which high density recording was carried out will become difficult.

[0051]As for the hyaline layer in hyaline layer drawing 3, it is preferred to constitute from material with high transmissivity to record and regenerated light. Although the component in particular of a hyaline layer is not limited, since a hyaline layer needs to be comparatively thick, it is preferred to use resin. Although the formation method in particular of a hyaline layer is not

limited, since a homogeneous hyaline layer can be formed in a short time, it is preferred to constitute from activity energy-line hardening resin, such as resin, especially ultraviolet curing type resin.

[0052]As the hyaline layer which comprised ultraviolet curing type resin was described in explanation of a filter layer, the influence of a photopolymerization initiator will show comparatively steep absorption in a short wavelength region. Therefore, in order to secure transparency to record and regenerated light of a short wavelength region, it is necessary to choose the kind of photopolymerization initiator suitably according to the wavelength of the record and regenerated light to be used.

[0053]When a hyaline layer exists in contact with the base 2, in order to suppress reflection by both interface, in the wavelength of record and regenerated light, it is preferred that the difference of the refractive index of a hyaline layer and the refractive index of a base is 0.1 or less.

[0054]Transparent layer thickness in particular is not limited, but what is necessary is just to set it up so that the cross talk between data layers may be settled in tolerance level. As for transparent layer thickness, specifically, when using the usual optical pickup, it is preferred that it is not less than 30 micrometers. However, as for transparent layer thickness, since a thickness distribution will become large easily, internal stress will become large easily and the overall thickness of a medium will become large if a hyaline layer is too thick, it is preferred that it is 100 micrometers or less.

[0055]What is necessary is on the other hand, just to set up transparent layer thickness according to the resolution of the depth direction, so that the cross talk between data layers may be settled in tolerance level when using a confocal detecting optical system. As for transparent layer thickness, specifically, although it changes also with composition of the wavelength of data light, and a confocal detecting optical system, when the wavelength of data light shall be about 300-1000 nm for example, it is preferred that it is not less than 5 micrometers. In using a confocal detecting optical system, transparent layer thickness can be less than 30 micrometers, and it is satisfactory also as 20 micrometers or less.

[0056]As for the hyaline layer which consists of resin, when a medium is a disk-like, forming with a spin coat method is preferred. A comparatively homogeneous hyaline layer can be formed in a spin coat method. In a spin coat method, resin is supplied to the surface of the base fixed to the rotating table, a base is rotated, and resin is spread according to a centrifugal force. Since the feed hole used for a base when loading a drive is formed, resin cannot be supplied to a center of rotation (center of a base), but will be annularly supplied to the equal distance from a center of rotation. However, compared with a disk inner periphery, a disk peripheral part will become thick, so that a resin supplying position separates from a center of rotation. That is, the thickness unevenness in the diameter direction of a hyaline layer

becomes large. In a multilayered information medium, in order for the number of hyaline layers to also increase as the number of laminations of a data layer increases, transparent layer thickness distribution will be accumulated. As a result, even if data light entered at right angles to the base 2 in the disk peripheral part, the data light reflected on the data layer surface will not become vertical to the base 2, but, as a result, its amount of returned light to an optical pickup will decrease. Therefore, a reproducing output will be changed by the inner periphery and a peripheral part.

[0057]In an optical pickup provided with a confocal detecting optical system, a pinhole is arranged in an optical system and it reproduces by the light passing through this pinhole. Therefore, since the flattery range of a focus servo becomes narrow when using an optical pickup provided with a confocal detecting optical system, it is required that the homogeneity of transparent layer thickness should be higher.

[0058]Between the recorded information holding areas (recording track existence region) of the two-layer data layer which adjoins each other from such a situation, or -- in between the recorded information holding area of a data layer, and the servo-data holding areas of a servo layer -- a hyaline layer -- maximum thickness -- the difference with minimum thickness is 3 micrometers or less preferably, and is 2 micrometers or less more preferably. Reproducing output change can be controlled by making transparent layer thickness distribution small in this way. Although the difference of the maximum thickness of a hyaline layer and minimum thickness is so preferred that it is small, when using a spin coat method, it is difficult to make the above-mentioned difference into zero. If it is in limited within the limits which the above-mentioned difference described above, the influence which it has on reproducing output change is small. Therefore, the above-mentioned difference does not have to be less than 1 micrometer. In a disk like medium, the recorded information holding area is annular and, as for the width, it is common to be referred to as about 20-50 mm.

[0059]Although the filter layer containing resin layers other than a hyaline layer, for example, resin, and this and coloring matter, the protective layer by which it has been provided in the medium surface, a glue line, etc. may be formed with a spin coat, also in these resin layers, it is desired for a thickness distribution to be small like a hyaline layer.

[0060]In order to stop the thickness distribution of resin layers, such as a hyaline layer and a filter layer, in a mentioned range, it is preferred to perform a spin coat by the following method using the following device.

[0061]The case where hyaline layer tangent line-1 of the medium shown in drawing 3 is formed hereafter is mentioned as an example, and is explained. In this method, first, as shown in drawing 6 and drawing 7, the base 2 which has the feed hole 101 is laid on the rotating table 200. When forming hyaline layers other than tangent line-1, the information holding layer, or this and a resin layer are provided in the base 2 surface. The feed hole 101 inserts the base 2

in the annular projection 201 of the rotating table 200, and it is crowded and is fixed. Although these figures are sectional views, only the end face which appears in a section is displayed and the graphic display of the depth direction is omitted. Also in the sectional view after this, it is the same.

[0062]Subsequently, the blocking means 300 closes the feed hole 101. This blocking means 300 is provided with the following.

The disk part 301 for taking up the feed hole 101.

The supporting spindle 302 unified in the center.

Heights 303 united with the side which counters the feed hole 101 by the disk part 301.

In the heights 303, the blocking means 300 is fixed to the rotating table 200 by fitting into the inner periphery of the projection 201, and positioning with the base 2 and the blocking means 300 can be performed. However, especially the fixing method to the base 2 and the rotating table 200 of the blocking means 300 is in the state into which it was not limited, for example, the base 2 and the blocking means 300 fitted, and may make the blocking means 300 fit into the rotating table 200.

[0063]Next, as shown in drawing 8, the coating liquid 500 which consists of resin or a resin solution is breathed out from the nozzle 400 which is a discharging means, and the coating liquid 500 is supplied to the peripheral face of the supporting spindle 302. this time -- the rotating table 200 -- comparatively -- a low speed -- it is made to rotate at 20-100 rpm preferably, and is made for coating liquid to spread uniformly on the disk part 301

[0064]Subsequently, as shown in drawing 9, the coating liquid 500 is spread by rotating the rotating table 200 comparatively at high speed. Thereby, hyaline layer tangent line-1 is formed on the base 2.

[0065]The spreading conditions in particular of coating liquid are not limited. When conditions other than the viscosity of coating liquid are made the same in a spin coat method, theoretically, it is known that the thickness of a coat is proportional to the square root of the viscosity of coating liquid. On the other hand, a coat becomes thin, so that turnover time is so long that number of rotations is large. Therefore, what is necessary is just to determine suitably the number of rotations and turnover time at the time of a spin coat according to the thickness of hyaline layer tangent line-1 and the viscosity of coating liquid to form.

[0066]Next, as shown in drawing 10, the blocking means 300 is estranged from the base 2. With alienation of the periphery edge of the disk part 301, the internal circumference edge of hyaline layer tangent line-1 rises, and the annular heights 600 are formed so that it may illustrate. The annular heights 600 are fields where the resin which constitutes hyaline layer tangent line-1 is rising continuously.

[0067]When the coating liquid to be used contains ultraviolet curing type resin, as shown in drawing 11, it irradiates with ultraviolet rays and hyaline layer tangent line-1 is hardened. In

drawing 11, although it is irradiating with ultraviolet rays on the rotating table 200, the stage for hardening may be provided apart from a rotating table, and it may harden on it. A blocking means may be estranged rotating a base.

[0068]The annular heights 600 formed by this method serve as a smooth curve (arc) so that the outline of that section may illustrate. On the other hand, when the blocking means 300 is estranged after hardening hyaline layer tangent line-1, though the heights which continued annularly are not formed but heights are formed, it is based on generating of a barricade and does not serve as annular heights which follow a hoop direction. There is also a problem of resin after hardening serving as a fragment in this case, and being easy to disperse on the base 2.

[0069]The height of the annular heights 600, i.e., the height from the lowest resin layer surface near the annular heights to an annular heights crowning, is usually set to 1-100 micrometers. The distance from the lowest position to the internal circumference edge of a hyaline layer is usually set to 0.5-3 mm width [the width of the annular heights 600], i.e., the annular heights of a transparent layer surface neighborhood. The height and width of annular heights usually become large, so that a resin layer is thick.

[0070]After forming hyaline layer tangent line-1 of the 1st layer, data layer DL-1 of the 1st layer is formed using a sputtering technique etc. A data layer is formed so that the internal circumference edge may be located in the periphery side rather than the internal circumference edge of a hyaline layer.

[0071]Subsequently, hyaline layer tangent line-2 of a two-layer eye is again formed using the blocking means 300. At this time, the annular heights 600 exist in the internal circumference edge of hyaline layer tangent line-1 of the 1st layer. Therefore, if the same blocking means 300 as what was used for formation of tangent line-1 is used, spreading of resin will be barred by the annular heights 600 and it will be easy to produce trouble in formation of tangent line-2 by them. Since annular heights arise also in tangent line-2 and the annular heights of tangent line-1 and the annular heights of tangent line-2 lap, the thickness of the resin layer in near disk inner circumference will separate greatly from a designed value, and the distance between data layers will spread near disk inner circumference.

[0072]In order to solve such a problem, in this invention, it faces forming two or more resin layers, and the annular heights of each class are shifted mutually and formed. The sectional view near an internal circumference edge is shown in drawing 12 about the base 2 which provided hyaline layer tangent line-1 - tangent line-4, and data layer DL-1 - DL-4 by turns. In the figure, in the state where the inside diameter is large and each hyaline layer was laminated as a result as the hyaline layer far from the base 2, the inner periphery edge of a transparent regular placing layer becomes stair-like. And the annular heights 600 are exposed to the step surface of this stair-like part. Thus, if each hyaline layer is laminated stair-like so that the

annular heights of other hyaline layers may not be covered, the above-mentioned problem is solvable.

[0073]What is necessary is to face forming hyaline layer tangent line-2 of a two-layer eye, and just to use the blocking means 300 as shown in drawing 13, in order to make the inner periphery edge of a transparent regular placing layer stair-like in this way. Although the process shown in drawing 13 is the same as the process which the base 2 which provided hyaline layer tangent line-1 is used, and also is shown in drawing 6 almost, the blocking means 300 to be used differ. This blocking means 300 has a diameter of the disk part 301 larger than what is shown in drawing 6, in order to form a hyaline layer with a bigger inside diameter than hyaline layer tangent line-1. The undersurface of the disk part 301 is made into ********** shape so that the flat part of hyaline layer tangent line-1 can be touched ranging over the annular heights 600. What is necessary is just to use a blocking means with the disk part which can cover the annular heights of the hyaline layer which is the same shape and was formed just before that, when forming the hyaline layer after the 3rd layer.

[0074]The blocking means used in a described method has a disk part for taking up the feed hole of a disc substrate at least, and other composition in particular should not just be limited. The method of carrying out a spin coat using the blocking means which takes up the feed hole of a disc substrate is indicated, for example in JP,10-320850,A, the 10-249264 gazette, the 10-289489 gazette, the 11-195250 gazette, and the 11-195251 gazette. In order to reduce the thickness unevenness in the diameter direction of a resin layer, in these gazettes, blocking means, such as a tabular member, a disk part, a blocking plate, and a cap, close the feed hole of a disc substrate, and the method of supplying resin (near a center (i.e., near a center of rotation) this blocking means) is indicated in them. There is also no statement of the purport that there is no statement about a multilayered information medium, and annular heights are formed in the internal circumference edge of a resin layer in the case of a spin coat in these each gazette. There is also a problem of explaining below in the blocking means indicated in these each gazette.

[0075]It is difficult for above-mentioned JP,10-320850,A, JP,10-249264,A, and JP,11-195250,A not to indicate the method of removing behind a spin coat, but to use industrially the tabular member thru/or cap which is a blocking means. In these gazettes, after estranging a blocking means from a disc substrate, hardening a resin layer is not indicated.

[0076]Behind the spin coat, after removing the disk part which is a blocking means by adsorption by punching or an electromagnet in above-mentioned JP,10-289489,A, hardening a resin layer is indicated to it, rotating a disc substrate. However, since big acceleration is added to a blocking means when removing a blocking means with punching and an electromagnet, it is easy to produce disorder in a resin paint film.

[0077]In above-mentioned JP,11-195251,A, the blocking means of the structure which unified

the base material in the center of a cap of a circle configuration is indicated. In the gazette, it is indicated by forming this base material that attachment and detachment and alignment of a blocking means become easy. This base material is [whether it is a hollow cylinder-like thing which has at least one hole, and] two or more rod-like structures. After pouring resin into the field surrounded by the inside or two or more rod-like structures of the hollow cylinder, a resin layer is formed on a disc substrate by rotating a disc substrate and a blocking means in one. If this blocking means is used, removal of a blocking means will become easy. In the gazette, after estranging a blocking means from a disc substrate, hardening a resin layer in the state where the disc substrate was made to stand it still is indicated.

[0078]In the gazette, resin is made to flow out of between the hole provided in the hollow cylinder of the blocking means, or adjacent rod-like structures, and a spin coat is performed. Therefore, resin will be dammed up by the wall (hole field of an except) or rod-like structure of a base material. The dammed-up resin may flow out on a disc substrate at once to the timing which cannot be predicted. Therefore, it is easy to produce unevenness in a coat. Its shape of a field of contacting resin is complicated, and since this blocking means has a large area in contact with resin, washing of a blocking means is difficult for it. If resin remains on the blocking means surface, it will be easy to produce unevenness in a coat. Although thickness change of the coat is investigated in Table 1 of the gazette about the case where the outer diameter of a hollow cylinder is 4-16 mm, as for the thickness unevenness of a coat, this result shows that thickness unevenness becomes large depending on the outer diameter of a hollow cylinder, so that an outer diameter is large. That is, even if it supplies resin to the inside of a hollow cylinder, a coating start position is not in agreement with a center of rotation, and it is thought that the peripheral position of a hollow cylinder turns into a coating start position. Since it is difficult for the outer diameter of a hollow cylinder to be less than 4 mm if it takes that viscosity is comparatively high into consideration, it is difficult for resin to make thickness unevenness of a resin paint film remarkably small in a method given [the] in a gazette.

[0079]The handling of the blocking means 300 in a medium manufacturing process becomes easy, and the blocking means 300 shown in drawing 6 to such a conventional blocking means becomes easy [removing the blocking means 300 behind a spin coat especially] in order to form the supporting spindle 302 in the disk part 301.

[0080]Although the blocking means which united with the cap the base material which consists of hollow cylinder-like a base material or two or more rod-like structures is indicated in said JP,11-195251,A, there is an advantage explained below in the blocking means shown in drawing 6 compared with this.

[0081]In said JP,11-195251,A, since resin will be dammed up by the wall or rod-like structure of a base material, as mentioned above, it is easy to produce unevenness in a coat. On the other hand, in the blocking means shown in drawing 6, in order to supply coating liquid to the

peripheral face of a supporting spindle and to perform a spin coat, it is hard to produce unevenness in a coat. Since it is a peripheral face of a supporting spindle, compared with said JP,11-195251,A, washing of a blocking means is easy for resin adhering in the blocking means shown in drawing 6. In said JP,11-195251,A, since coating liquid is supplied to the inside of a hollow cylinder-like base material, in order to secure the mobility of the comparatively high coating liquid of viscosity, the outer diameter of a base material will not be able to be made small, therefore a coating start position will become comparatively far from a center of rotation. On the other hand, in the blocking means shown in drawing 6, since the outer diameter of a supporting spindle can be made remarkably small compared with the gazette, the thickness unevenness of a coat can be reduced remarkably.

[0082]Such an effect will be realized if it is a blocking means which has not only the composition shown in drawing 6 but a disk part, and a supporting spindle. Although the blocking means 300 shown in drawing 6 has the truncated cone form disk part 301 and the cylindrical supporting spindle 302, it is usable also in the blocking means of composition of being shown, for example in drawing 14 (A) - drawing 14 (D), respectively.

[0083]The blocking means shown in drawing 14 (A) is provided with the following.

It is the disk part 301 of ********** truncated cone form about the undersurface like what is shown in drawing 13.

The supporting spindle 302 of reverse truncated cone shape.

Since the coating start position of coating liquid can be close brought by the center of the disk part 301 if this blocking means is used, the thickness unevenness of a coat can be reduced further. And unlike the case where the whole supporting spindle 302 is made thin, the fall of the mechanical strength of the supporting spindle 302 can be suppressed. Since it becomes difficult to fall when grasping the supporting spindle 302 by a zipper etc., it is advantageous in the case of attachment and detachment of a blocking means, and conveyance. The whole supporting spindle 302 does not need to be reverse truncated cone shape. That is, at least some supporting spindles 302 are the truncated cone form which a diameter dwindles toward the disk part 301, and it is good if the diameter of a supporting spindle does not become large in the field near a disk part from it.

[0084]The blocking means shown in drawing 14 (B) differs in the sectional shape of the disk part 301 from drawing 14 (A). In order to spread coating liquid uniformly on the disk part 301, it is preferred that the thickness of the disk part 301 gradually decreases toward a peripheral part. In that case, in the section of the disk part 301, the shape of an upper limb where coating liquid is spread may be linear shape as shown in drawing 14 (A), and as shown in drawing 14 (B), it may be a curve-like. As shown in drawing 14 (C), the periphery of the disk part 301 may be a vertical plane. However, in drawing 14 (C), thickness t in the periphery of the disk part 301 is 0.4 mm or less preferably. If thickness t is too large, it will become difficult to apply a

resin layer uniformly. It is good also as uniform in the thickness of the disk part 301, as shown in drawing 14 (D).

[0085]In order to make the blocking means shown in drawing 14 (A) - drawing 14 (D), respectively correspond to formation of the resin layer after a two-layer eye, it has made the undersurface of the disk part 301 ********** shape.

[0086]In a blocking means, the minimum diameter of the supporting spindle 302 in about 301 disk part is 2 mm or less more preferably less than 4 mm. If the diameter of the supporting spindle 302 in about 301 disk part is too large, a coating start position will separate from the center of the disk part 301, and the thickness unevenness in the diameter direction of a resin layer will become large. However, since the mechanical strength of the supporting spindle 302 will become insufficient if the diameter of the supporting spindle 302 in about 301 disk part is too small, the above-mentioned minimum diameter is 0.7 mm or more more preferably 0.5 mm or more. Although what is necessary is just to determine suitably in consideration of the ease of the handling at the time of grasping, etc. so that the length in particular of the supporting spindle 302 may not be limited but the supply of coating liquid to the peripheral face may become easy, it may be 10-30 mm more preferably 5-100 mm. If the supporting spindle 302 is too short, it will become difficult to carry out supply of coating liquid to a peripheral face, and will also become difficult to grasp. On the other hand, handling will become troublesome if the supporting spindle 302 is too long.

[0087]The diameter of the disk part 301 is larger than the diameter of the feed hole 101 of a disc substrate, and should be just smaller than the inside diameter of the annular information storage side which a disc substrate has. However, since the coating liquid 500 turns to the undersurface of the disk part 301 and may pollute the peripheral surface (inner skin of a disc substrate) of the feed hole 101, the thing large not less than 8 mm of especially the diameter of the disk part 301 is more preferred than the diameter of the feed hole 101 not less than 4 mm. Since it is easy to produce disorder in the shape of the resin layer of the neighborhood when removing the disk part 301, the thing small not less than 5 mm of especially the diameter of the disk part 301 is more preferred than the inside diameter of an information storage side not less than 3 mm. Although a concrete size changes also with the diameter of a feed hole, and inside diameters of an information storage field, when applying to manufacture of about 60-130 mm in diameter an optical disc, it is usually preferred [especially the diameter of the disk part 301] to carry out within the limits of 25-38 mm 20-40 mm.

[0088]The component in particular of a blocking means may not be limited, but may be any, such as metal, resin, and ceramics, and may be a composite material using these two or more sorts. The disk part 301 and the supporting spindle 302 may consist of different materials. However, as for a blocking means, since a mechanical strength, endurance, and dimensional accuracy are good, constituting from metal is preferred. As metal, a stainless alloy, aluminum,

and an aluminum alloy are preferred, for example.

[0089]As for the surface of the blocking means 300, especially all the surfaces of the disk part 301, it is preferred that surface tension is lower than coating liquid. If the surface of the blocking means 300 does not get wet easily to coating liquid, washing of the coating liquid which adhered on the surface of the blocking means will become easy. Although control of surface tension is possible also by choosing the component of a blocking means suitably, it is preferred to perform water-repellency and oil-repellent processing of Teflon (registered trademark) processing etc. to a field to make surface tension low.

[0090]A servo layer servo layer is a reflecting layer formed in the servo base 20 surface in which unevenness holding tracking servo information was provided, and holds the tracking servo information corresponding to said unevenness. As said unevenness, a groove and/or a pit are common.

[0091]It is good like the reflecting layer provided in the conventional optical information medium then, and what is necessary is not to limit the composition in particular of the reflecting layer which constitutes a servo layer, but just to usually consist of alloys containing the simple substances of metal, such as aluminum, Au, Ag, Pt, Cu, nickel, Cr, Ti, and Si, or semimetal, or these one or more sorts. As for the thickness of a reflecting layer, it is usually preferred to be referred to as 10-300 nm. It becomes difficult to obtain sufficient reflectance with thickness being less than said range. Even if it exceeds said range, the improvement in reflectance is small and becomes disadvantageous in cost. As for a reflecting layer, it is preferred to form with vapor phase growth, such as a sputtering technique and vacuum deposition.

[0092]When applying data layer this invention to an optical recording medium, the recording layer containing a recording material is contained in a data layer at least. The optical recording medium in particular with which this invention is applied may not be limited, for example, may be any, such as a rewritable type medium using a phase change type recording material or an added type medium of a postscript, a rewritable type medium using magneto-optical recording material, and an added type medium of a postscript using organic coloring matter as a recording material. However, compared with other recording materials, light transmittance is high, therefore since the number of laminations of a recording layer is increased, it is preferred to use a phase change type recording material.

[0093]Although the presentation in particular of a phase change type recording material is not limited, what contains Sb and Te at least is preferred. Its crystallization temperature is as low as about 130 **, and since the recording layer which consists only of Sb and Te has insufficient preservation reliability, it is preferred to add other elements. As an alloying element in this case, the element M (the elements M are at least one sort of elements chosen from In, Ag, Au, Bi, Se, aluminum, P, germanium, H, Si, C, V, W, Ta, Zn, Ti, Ce, Tb, Sn, Pb, Pd, and Y) is preferred. Among these, especially germanium is preferred from a preservation reliability

improved effect being high.

[0094]When the atomic ratio of a recording layer composing element is expressed with formula I $Sb_aTe_bM_c$ and it is referred to as a+b+c=1, it is a= 0.2 to 0.85, b= 0.1 to 0.6, and c= 0-0.25 preferably, and is c= 0.01-0.25 more preferably. Since a crystallization rate will not become quick enough if there is too little Sb content, over-writing becomes difficult. On the other hand, if there is too much Sb content, a crystallization rate will become quick too much and it will become difficult to form an amorphous recording mark. The effect by M addition becomes insufficient, if there is too little M content, if there is too much M content, the reflectance change accompanying a phase change will become small, and enough modulation factors will be hard to be obtained. If there is too little Te content, it will become difficult for amorphous-ization to become difficult and to form a recording mark. On the other hand, if there is too much Te content, a crystallization rate will become slow and over-writing will become difficult.

[0095]Although a phase change type recording medium is generally used as a rewritable type medium, it may be used as an added type medium of a postscript by this invention. The added type medium in this case of a postscript is a medium which is not guaranteed about elimination of the once recorded recording mark although record is possible, and eliminating the recording mark of a recorded recording track and recording again is a medium which is not carried out. The advantage by using it as an added type medium of a postscript is explained below.

[0096]In a multilayer recording medium, in order to knead two or more-fold recording layer, the light volume loss of record and regenerated light becomes large. Therefore, it is necessary to make a recording layer as thin as possible. However, if a recording layer is made thin, the cooling rate of the recording layer after a recording light exposure will become quick. Since it will become difficult to crystallize if a cooling rate becomes quick, in order to secure an erase rate, it is necessary to consider it as the presentation which is easy to crystallize a recording layer. That is, it is necessary to make the crystallization rate of a recording layer comparatively quick. However, there is a problem of being easy to generate the self erasion explained below in a recording layer with a quick crystallization rate. At the time of record, heat is spread in recording layer side inboard from the beam spot of recording light, and cooling of a recording mark is checked by this heat. If the crystallization rate of a recording layer is quick, a part of recording mark will recrystallize by this cooling inhibition, and a recording mark will contract. A recording mark tip part (part where the beam spot was irradiated previously) is eliminated, or, specifically, a recording mark rear end part is eliminated. Such a phenomenon is called self erasion on these specifications. If self erasion arises, a C/N fall and jitter increase will arise.

[0097]Thus, when a recording layer is made thin, it is difficult to fully secure an erasing quality and to control self erasion. Since it is not necessary to eliminate a recording mark, it becomes unnecessary on the other hand, to take the crystallization rate of a recording layer into consideration, in using the medium which has a phase change type recording layer as an

added type medium of a postscript. Therefore, it is satisfactory even if the influence of self erasion reduces the crystallization rate of a recording layer to the grade which is not produced substantially by the composition control of a recording layer. In an over-write, it is necessary to make the crystallization rate of a recording layer quick, so that the linear velocity of the medium at the time of record is quick, therefore becomes easy to produce self erasion. However, since it is recordable on a recording layer with a comparatively late crystallization rate which self erasion does not produce easily with high linear velocity, for example, the linear velocity of about 10 or more m/s, if only 1-time record instead of over-writing is performed, a high data transfer rate is easily realizable.

[0098]In this invention, as mentioned above, in order to knead two or more-fold recording layer, the light volume loss of record and regenerated light becomes large. Therefore, in the range by which the function as a recording layer is not spoiled, the thing of a recording layer thin as much as possible is preferred. However, if too thin, the function as a recording layer will be spoiled. Therefore, 2-50 nm of thickness of a recording layer shall be 4-20 nm more preferably.

[0099]As for a data layer, when using a phase change type recording layer, it is preferred to consider it as the structure illustrated as DL-1 to drawing 3. This data layer is the structure which sandwiched the recording layer 4 by the 1st dielectric layer 31 and the 2nd dielectric layer 32. As for a recording layer and each dielectric layer, in this structure, forming by a sputtering technique is preferred. The various compounds which contain at least one sort of metallic components chosen from Si, germanium, Zn, aluminum, a rare earth element, etc. as a dielectric used for a dielectric layer, for example are preferred. As a compound, an oxide, a nitride, a sulfide, or fluoride is preferred, and the mixture containing two or more sorts of these compounds can also be used. As for the thickness of each dielectric layer, it is preferred that it is 10-500 nm.

[0100]In this invention, in order to reduce the light volume loss of record and regenerated light, it is preferred to make a recording layer thin, but if a phase change type recording layer is made thin, a modulation factor will become low. That is, the difference of reflectance will become small in an amorphous recording mark and a crystalline substance field. In order to make this modulation factor high, it is preferred to make a dielectric layer into the layered product of two or more layers which differs in a refractive index. It is also possible by considering it as such multilayer structure for the flexibility of an optical design to improve and to raise the light transmittance of the whole data layer. As a dielectric layer of multilayer structure, the layered product of at least one layer chosen from a magnesium fluoride layer, a manganese fluoride layer, a germanium dioxide nitride layer, and a silicon oxide layer and a $ZnS\text{-}SiO_2$ layer is mentioned, for example.

[0101]If the plural laminates of the recording layer are carried out, the record luminous intensity

which reaches each recording layer will become so low that the recording layer is far from the record light incidence side surface of a medium. Therefore, it is preferred to adjust the recording sensitivity of a recording layer according to the reaching record luminous intensity. In the recording material to which heat mode records, such as a phase change type recording material, are performed, since accumulation nature will improve if a recording layer is thickened, recording sensitivity improves. Therefore, it is preferred to thicken relatively the further recording layer from a record light incidence side surface if needed. However, an adjacent two-layer recording layer is good also as the same thickness. As for a recording layer far from a light incidence side surface, since the record and regenerated light which penetrated other recording layers will be used, in order to equalize the reproducing characteristics of each recording layer, it is preferred that the recording layer nearer to a light incidence side surface has higher light transmittance. For that purpose, it is preferred that the further recording layer from a record light incidence side surface thickens.

[0102]Recording sensitivity adjustment and transmissivity adjustment of a recording layer can also be performed by controlling the presentation of a recording layer. In that case, it is good also as the same in the thickness of all the recording layers, and composition control and thickness control may be combined.

[0103]This invention is applicable also to an only for [reproduction] type medium. The data layer in that case may be a layer which has a pit holding recorded information, and may be a layer which recorded data on the added type medium of a postscript beforehand. In the case of the former, a pit is formed in a hyaline layer thru/or a filter layer, and a translucent reflecting layer is usually formed in the pit forming face by a sputtering technique etc. In that case, a reflecting layer turns into a data layer. As a translucent reflecting layer, an ultra-thin metal layer and Si layer are mentioned, for example. In order to equalize a regenerative-signal output, the reflectance of a data layer may be controlled by such an only for [reproduction] type medium. In that case, what is necessary is just to make reflectance high as a data layer with little reaching light volume. Since light transmittance can be made high as the data layer near a light incidence side surface if reflectance is controlled in this way, remarkable attenuation of the light volume which reaches a data layer far from a light incidence side surface can be prevented.

[0104]In this invention, an information holding layer's number of laminations in particular may not be limited, but may be any more than two-layer. However, since the influence of the transparent layer thickness distribution which a medium becomes thick too much and is formed by a spin coat method will become large if there are too many laminations, an information holding layer's number of laminations is six or less more preferably ten or less.

[0105]When two or more information holding layers are piled up, the reflected light quantity from an information holding layer decreases. However, according to this invention persons'

research, even if the information holding layer's maximum reflectance was 5% or less, it turned out that C/N sufficient in a data layer is obtained, and servo signal intensity sufficient in a servo layer is obtained. However, as for an information holding layer's maximum reflectance, since neither C/N nor servo signal intensity can fully secure if reflectance is too low, it is preferred that it is 0.1% or more.

[0106]As for the base 2, since the base 2, and servo base 20 record and regenerated light are irradiated through the base 2, it is preferred to constitute from transparent construction material, for example, resin, glass, etc., substantially to such lights. Handling is easy, and since it is cheap, resin is [among these] preferred. What is necessary is just to specifically use various resin, such as an acrylic resin, polycarbonate, an epoxy resin, and polyolefine. However, since the absorptivity of record and regenerated light becomes high in polycarbonate when using record and regenerated light with a short wavelength of about 450 nm or less, for example, it is preferred to use material with a light absorption rate low in that case in a short wavelength region, for example, amorphous polyolefine.

[0107]Although in particular the shape and the size of the base 2 are not limited, it is a disk-like, and preferably, the thickness is 30 micrometers - about 3 mm, and not less than 5 micrometers of diameters are usually about 50-360 mm.

[0108]Although what is necessary is just to constitute it from resin or glass like the base 2, since the servo base 20 shown in drawing 3 can form unevenness holding servo data easily by injection molding, constituting from resin is preferred. The servo base 20 does not need to be transparent. What is necessary is just to set up especially the thickness of the servo base 20 suitably within limits which it was not limited, for example, were mentioned in explanation of the base 2. However, when the rigidity of the base 2 is low, it is preferred to make the servo base 20 comparatively thick and to secure the rigidity as the whole medium.

[0109]Above, it had the filter layer, and the multilayered information medium used for the system using two or more record and regenerated light in which wavelength is different was mentioned as the example, and was explained. However, since the main effects by this invention are realized when forming a resin layer with a spin coat method in a multilayered information medium, this invention is effective also about a medium without a filter layer.

[0110]

[Example]In an one or less-example procedure, the optical recording disk sample of the structure shown in drawing 3 was produced.

[0111]Hyaline layer tangent line[of four layers]-1 - tangent line-4, and data layer DL[of four layers]-1 - DL-4 were formed in one field of the base 2 which consists of a glass disk 1.2 mm in thickness, and 120 mm in diameter which carried out strengthening processing of the both-sides surface by turns.

[0112]Each hyaline layer was formed in the following procedures using this invention method

for using a blocking means. The used blocking means comprises a stainless alloy and has the shape shown in drawing 13. The diameter of the disk part 301 is 38 mm in what was used for 33 mm and tangent line-4 formation in what was used for 28 mm and tangent line-3 formation in what was used for 23 mm and tangent line-2 formation in what was used for tangent line-1 formation. The supporting spindles 302 are 1 mm in diameter, and 20 mm in length in every blocking means. The blocking means was removed, after having supplied the peripheral face of the supporting spindle 302, ranking second and carrying out the spin coat of the ultraviolet curing type resin (SD318 by Dainippon Ink & Chemicals, Inc.) for 5 seconds at the number of rotations of 3000 rpm, rotating a rotating table at 60 rpm after the blocking means closed the feed hole of the base. Subsequently, it hardened by irradiating with ultraviolet rays, and the hyaline layer was formed.

[0113]Thus, about each formed hyaline layer, when the thickness distribution was measured with the laser focus displacement gage, also in which hyaline layer, average thickness is 13.6 micrometers, and the difference (thickness distribution) of maximum thickness and minimum thickness was settled in less than 2 micrometers. Measurement of thickness was performed at intervals of 5 mm in the diameter direction of a recorded information holding area (field with a radius [a disk center to] of 20-58 mm). Near the internal circumference edge of a hyaline layer has become stair-like as shown in drawing 12, and the annular heights 600 of each hyaline layer had not lapped. The annular heights of each hyaline layer were 15 micrometers in height, and 1.5 mm in width.

[0114]The presentation (atomic ratio) of the recording layer 4 contained in a data layer was made into $Sb_{22.1}Te_{56.0}germanium_{21.9}$. The thickness of the recording layer 4 was 5 nm, 5 nm, 7 nm, and 13 nm from the thing nearest to a data light incidence side surface at order. The recording layer 4 was formed by magnetron sputtering, and the thickness was adjusted by controlling the supplied power at the time of weld slag, a pressure, and sputtering time.

[0115]After the thickness of the 1st dielectric layer 31 and the 2nd dielectric layer 32 contained in each data layer secured the absorptivity of the recording layer, it was set up within the limits of 75-271 nm so that the light transmittance of the whole data layer might become high. Each of these dielectric layers was formed by magnetron sputtering, and each presentation was made into ZnS(80-mol %)-SiO_2 (20-mol %).

[0116]On the other hand, it was formed of injection molding and 0.76 micrometer in width, 1.2 mm in thickness which provided the 183-nm-deep groove, and the servo base 20 which consists of a polycarbonate disk 120 mm in diameter were prepared. 100-nm-thick Au membrane was formed in the groove forming face of this servo base 20 by weld slag, and it was referred to as servo layer SL. Filter layer floor line was formed in this reflecting layer surface. Filter layer floor line was formed by irradiating with ultraviolet rays, after carrying out the spin coat of the mixture (coloring matter content 3 mass %) of phthalocyanine system

coloring matter (Blue-N by Nippon Kayaku Co., Ltd.), and ultraviolet curing type resin (SD318 by Dainippon Ink & Chemicals, Inc.) for 5 seconds at the number of rotations of 3500 rpm. On the occasion of a spin coat, the above-mentioned blocking means used for formation of hyaline layer tangent line-1 was used. Thus, when thickness was measured like the hyaline layer about formed filter layer floor line, the average thickness of the filter layer was settled in 11 micrometers, and the thickness distribution was settled in less than 2 micrometers.

[0117]In the wavelength of 780 nm, the absorptivity of filter layer floor line was 8% 95% in the wavelength of 660 nm. This absorptivity is the value which formed the filter layer independently on the above-mentioned conditions on the transparent plate, and was measured about this.

[0118]Next, after ultraviolet curing type resin (DVD-003 by Nippon Kayaku Co., Ltd.) was dropped at the uppermost surface (data layer DL-4 surface of the top layer) of the layered product containing the base 2, it carried aligning the layered product containing the servo base 20, and the whole was rotated for 2 seconds at 5000 rpm. Subsequently, the above-mentioned ultraviolet curing type resin was hardened by irradiating with ultraviolet rays through the base 2. The optical recording disk sample of the structure which the layered product containing the base 2 and the layered product containing the servo base 20 are stuck by this via 35-micrometer-thick hyaline layer tangent line-5, and is shown in drawing 3 was formed.

[0119]After initializing the recording layer of the sample of bit contrast ** with a bulk eraser (crystallization), in the state where the sample was made to stand it still. It recorded by having irradiated with the data light for record of the wavelength of 660 nm, and 50 ns of pulse width through the base 2, it irradiated with the data light for reproduction of the wavelength, and bit contrast was measured for every data layer. The optical pickup which has a confocal detecting optical system was used for the exposure of data light, and detection of the catoptric light. The numerical aperture of the object lens of this optical pickup is 0.52. This measurement showed that sufficient bit contrast was acquired in all the data layers of four layers. Dispersion in the recording sensitivity between data layers was also small enough.

[0120]Rotating the C/N (carrier to noise ratio) above-mentioned sample, the single signal with which the pulse of the same length continues at a fixed interval was recorded on each data layer of the sample, and C/N when this was reproduced was measured. The recording pulse was taken as 50% of duty ratio. Data light with a wavelength of 660 nm was used for record and reproduction. By servo light with a wavelength of 780 nm, servo layer SL was read on the occasion of record and reproduction, and the tracking servo was performed at it. This measurement showed that C/N high enough was obtained.

[0121]The random signal of one to 7 abnormal conditions (mark length 2T-8T) was recorded on the bit error rate above-mentioned sample, and the bit error rate (BER) when this was reproduced was measured. This measurement showed that a bit error rate was sufficiently low.

[0122]Not using comparative example 1 blocking means, ultraviolet curing type resin was dropped at a position 18 mm in radius, the spin coat was performed, spin coat conditions were carried out for [number-of-rotations / of 2500 rpm /, and turnover time] 4 seconds, and also hyaline layer tangent line-1 - tangent line-4 were formed like Example 1. As a result of performing thickness measurement like Example 1 about these hyaline layers, average thickness is 14.7 micrometers, a thickness distribution is 8.2 micrometers or less, and the thickness distribution became remarkably large compared with Example 1.
[0123]Example 2 spin-coat conditions were carried out for [number-of-rotations / of 2500 rpm /, and turnover time] 3 seconds, and also hyaline layer tangent line-1 - tangent line-4 were formed like Example 1. As a result, the average thickness of each hyaline layer was settled in 20 micrometers, and the thickness distribution was settled in less than 2 micrometers.
[0124]Spin coat conditions were carried out for [number-of-rotations / of 6000 rpm /, and turnover time] 4 seconds using SSP50U10 by Showa High Polymer Co., Ltd. as example 3 ultraviolet curing type resin, and also hyaline layer tangent line-1 - tangent line-4 were formed like Example 1. As a result, the average thickness of each hyaline layer was settled in 28 micrometers, and the thickness distribution was settled in less than 2 micrometers.
[0125]
[Effect of the Invention]Machine accuracy is good in order to keep the annular heights which use the above-mentioned blocking means for formation of a resin layer, and are formed in the internal circumference edge of each resin layer from lapping, when manufacturing the multilayer recording medium which laminated two or more information holding layers in this invention, An optical disc with a small reproducing output change and good playback stability is obtained easily.

[Translation done.]